

**REMARKS**

Claims 49-52, 55-74, 77 and 78 are pending in this application. By this Amendment, claims 49-52, 55-58, 73, 74, 77 and 78 are amended, and claims 28-48, 53, 54, 75, 76 and 79 are canceled. Support for the amendments may be found, for example, in the specification at page 46, lines 10-22, and in the original claims. No new matter is added.

In view of the foregoing amendments and the following remarks, reconsideration and allowance are respectfully requested.

**I. Claim Objections**

**A. Claims 49-72**

The Office Action objects to claims 49-72 due to informalities. By this Amendment, the claims are amended to overcome the objection. Thus, reconsideration and withdrawal of the objection are respectfully requested.

**B. Claims 53 and 54**

The Office Action objects to claims 53 and 54 under 37 C.F.R. 1.75 as being a substantial duplicate of claims 51 and 52. By this Amendment, claims 53 and 54 are canceled, rendering the objection moot. Thus, reconsideration and withdrawal of the objection are respectfully requested.

**II. Rejection Under 35 U.S.C. §112**

The Office Action rejects claims 49-72 and 77 under 35 U.S.C. §112, second paragraph, as being indefinite. By this Amendment, the claims are amended in light of the Examiner's comments. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**III. Rejection Under 35 U.S.C. §101**

The Office Action rejects claims 49-72 and 77 under 35 U.S.C. §101 for being directed to non-statutory subject matter. By this Amendment, the claims are amended in light

of the Examiner's comments. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**IV. Rejection Under 35 U.S.C. §102**

**A. Sakurada**

The Office Action rejects claims 49-54 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2003/0116082 to Sakurada et al. ("Sakurada"). By this Amendment, claims 53 and 54 are canceled, rendering their rejection moot. As to the remaining claims, Applicants respectfully traverse the rejection.

By this Amendment, claim 49 is amended to require that the "Cu concentration in a component made of quartz to be used in a part in which a temperature in a furnace for single crystal growth is 1000 °C or more is 1 ppb or less, and Cu concentration in a component made of quartz to be used in a part in which a temperature in the furnace for single crystal growth is less than 1000 °C is 10 ppb or less." Cu contamination in the single crystal growth is reduced and Cu precipitates can be prevented when a silicon single crystal is grown by using the claimed method. See specification, page 10, line 18 to page 13, line 5. Thus, a silicon single crystal of high quality can be produced at high production yield and low cost. Id. Sakurada does not disclose such limitations. For example, nowhere in Sakurada does it disclose a Cu concentration of "1 ppb or less" or "10 ppb or less."

Thus, Sakurada does not anticipate claim 49. Claims 50-52 depend from claim 49 and, thus, also are not anticipated by Sakurada for at least the same reasons. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**B. Oda**

The Office Action rejects claims 49, 50, 55-64 and 74 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2003/0000457 to Oda et al. ("Oda"). Applicants respectfully traverse the rejection.

**i. Claim 49**

As discussed above, claim 49 is amended to require a Cu concentration of "1 ppb or less" or "10 ppb or less." As a result of such features, silicon single crystal of high quality can be produced because Cu contamination in the single crystal growth is reduced and Cu precipitates can be prevented when a silicon single crystal is grown by using the claimed method. See specification, page 10, line 18 to page 13, line 5. Oda does not disclose, at least, a Cu concentration of "1 ppb or less" or "10 ppb or less."

**ii. Claim 74**

Claim 74 is directed to a method for producing a silicon single crystal, according to the Czochralski method, by cleaning in-furnace components by "taking out the in-furnace components," "transferring the in-furnace components to another room" where the cleaning is performed and the cleanliness is maintained at "class 1000 or more." Oda does not disclose such limitations.

For example, Oda does not disclose that the in-furnace components is transferred to another room, where the cleaning operation is performed. At most, Oda discloses a pulling room provided with several operation floors installed with single crystal pulling apparatuses where the dismantlement and cleaning operations of the furnace body is performed. See Oda at paragraphs [0040]-[0042]. However, Oda does not disclose that the in-furnace components are transferred to another room, which is different from the pulling room in which the furnace is provided, where the cleaning operation is performed.

Furthermore, Oda does not disclose the step of "maintaining the cleanliness in the room environment of the another room to be class 1000 or more" during the cleaning operation. Instead, Oda discloses that "the degree of cleanness of the uppermost floor set at class 1000 is degraded to about class 10,000 when the dismantlement and cleaning operations of inside of the furnace body is performed." See paragraph [0040]. Thus, the pulling room of

Oda discloses a cleanliness of the room environment of "about class 10,000," rather than "class 1000 or more," while the cleaning is performed.

**iii. Conclusion**

Thus, Oda does not anticipate claims 49 and 74. Claims 50 and 55-64 depend from claim 49 and, thus, also are not anticipated by Oda for at least the same reasons. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**V. Rejection Under 35 U.S.C. §103**

The Office Action rejects claims 65-73, 77 and 78 under 35 U.S.C. §103(a) as having been obvious over Oda, in view of U.S. Patent No. 6,344,083 to Holder ("Holder").

Applicants respectfully traverse the rejection.

**A. Claims 65-72**

Claims 65-72 depend from claim 49 and, therefore, contain all of the features of claim 49. As discussed above, Oda does not anticipate and also would not have rendered obvious claim 49 for at least the same reasons. Holder, which the Office Action applies for the additional features recited in claims 65-72, fails to cure the deficiencies of Oda. Specifically, Holder does not disclose a Cu concentration of "1 ppb or less" where a temperature in a furnace is 1000°C or more, or "10 ppb or less" where a temperature in a furnace is less than 1000°C. Thus, the applied references would not have rendered obvious claims 65-72.

**B. Claim 73**

The Office Action, at pages 8-9, asserts that Oda discloses a method of fabricating a Si single crystal material in a clean room class setting of 1000, but fails to disclose the fabrication of the Si single crystal melt by the claimed time and energy power parameters. The Office Action further asserts that Holder cures this deficiency because it discloses a method for producing a silicon single crystal that includes a melting and equilibrium phase of

the raw material for 3.5 hours. The Office Action further asserts that the claimed electric power setting of "80% or more" would have been obvious because an ordinarily skilled artisan would easily modify power settings based on desired results for achieving optimal conditions. Applicants respectfully disagree.

Claim 73 recites a method of producing a silicon single crystal where "after melting of a silicon raw material is finished, it is left for 3 hours or more on a condition that a heating heater is heated with an electric power of 80% or more . . . ." The claimed method provides high-quality silicon single crystals without any Cu precipitates because Cu removed from the HZ components are exhausted out of the furnace and silicon single crystal is grown thereafter, thereby reducing Cu contamination. See specification at page 19, line 19 to page 20, line 13. The applied references do not disclose such limitations.

At most, Oda discloses that a silicon single crystal is used in pulling apparatuses but does not disclose any of the steps for producing a silicon single crystal recited in claim 73. Holder fails to cure this deficiency. For example, Holder discloses that the melting and equilibration process takes about 3.5 hours. See Holder, Example. This period of time includes the time at which the silicon composition is "melted." However, the silicon single crystal of the claimed method is left for "3 hours or more" in a heater "after melting of a silicon raw material is finished." Thus, Holder fails to disclose a period of "3 hours or more" at which the silicon single crystal is left in a heater after melting of the silicon raw material.

With respect to the electric power setting, an ordinarily skilled artisan would not have had any reason or rationale to modify the electric power settings in Holder based on desired results for achieving optimal conditions. The purpose of leaving the claimed melted silicon material for 3 hours or more and setting the electric power at 80% or more is to clean the HZ components to the extent that Cu precipitates are not formed in the single crystal. See specification at page 18, lines 3-18. The process for producing single crystal ingots of Holder

has the purpose of reducing the amount of crystal defects by controlling the amount of insoluble gas trapped by a silicon melt. See Holder at column 2, lines 21-40. Nowhere in Holder does it describe cleaning of HZ components. Thus, there exists no reason or rationale for an ordinarily skilled artisan to modify the power settings in Holder because Holder does not set out to clean HZ components.

Thus, the applied references would not have rendered obvious claim 73.

**C. Claim 77**

By this Amendment, claim 77 recites a method for producing a silicon single crystal by using at least two or more of (1) an apparatus having a Cu concentration of "1 ppb or less" in a quartz component where a temperature in a furnace is 1000°C or more and "10 ppb or less" in a quartz component where a temperature in a furnace is less than 1000°C, (2) an apparatus where "devices and components being exposed in the furnace for single crystal growth do not contain Cu as a raw material," and (3) an apparatus having a Cu concentration in an observation window of "10 ppb or less." Oda and Holder do not disclose such features and, thus, would not have rendered obvious claim 77.

**D. Claim 78**

Claim 78 contains all of the features of claim 73. The deficiencies of Oda and Holder with respect to claim 73 are discussed above. Claim 78 would not have been rendered obvious by the applied references for at least the same reasons discussed above with respect to claim 73.

**E. Conclusion**

For at least these reasons, the applied references would not have rendered obvious claims 65-73, 77 and 78. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**VI. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



William P. Berridge  
Registration No. 30,024

Tommy T. Kim  
Registration No. L0543

WPB:TTK/nlp

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**OLIFF & BERRIDGE, PLC**  
**P.O. Box 320850**  
**Alexandria, Virginia 22320-4850**  
**Telephone: (703) 836-6400**

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